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EGGS AND THEIR VALUE AS FOOD.

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CONTENTS.

	Page.
Introduction	1
Description and composition of eggs	3
Cooking and serving eggs	12
Digestibility of eggs	15
Wholesomeness of eggs	16
The supply of eggs from the housekeeper's standpoint	17
Preserving eggs and its effect on the household supply	21
Frozen eggs, desiccated eggs, and egg substitutes	24
Importance of eggs as food and their place in the diet	25

INTRODUCTION.

Perhaps no article of diet of animal origin is more commonly eaten in all countries or served in a greater variety of ways than eggs. Hens' eggs are most common, although the eggs of domestic poultry other than hens are sometimes used. Guinea eggs are eaten where they are readily obtained and are much prized for their delicate flavor. Turkey eggs are mild in flavor and are eaten to some extent, though they are usually too valuable for hatching to be much used as food. Ducks' eggs are stronger or more pronounced in flavor than hens' eggs, the feed apparently exercising considerable influence on the flavor, but they are much liked by many and are now used more than formerly. Goose eggs are still stronger in flavor. Nevertheless, they have some use for table purposes, especially in regions where goose raising is common. In South Africa, where ostrich raising is an important industry, the eggs are used as food to some extent and are regarded as of excellent quality for cookery. Their food value is also recognized in those regions of the United States where ostriches are raised.

NOTE.—This bulletin is of special interest to housekeepers and to home-economics extension workers, teachers, and students. It summarizes data regarding the nature and uses of eggs and the effects of methods of handling, storing, and marketing upon the value of eggs in the household.

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The eggs of wild birds, once commonly used, are still eaten, but in a limited way. Plovers' eggs are prized by epicures and the eggs of certain kinds of sea birds have been used to some extent.[1]

Other eggs besides those of birds are also eaten. Turtles' eggs are generally highly prized and very commonly eaten where they can be obtained. The eggs of the terrapin are served with the flesh in some of the dishes prepared from it. Fish eggs, especially those of sturgeon, are eaten in large quantities preserved with salt, under the name of caviar. Shad roe is another illustration of the use of fish eggs.

Notwithstanding these minor instances, the term "eggs," when used in connection with food topics, refers to the eggs of birds, usually domestic poultry, and more particularly hens' eggs, and, unless qualified in some way, is used in the last sense in this bulletin.

Although man has been guided by instinct and experience in the selection of eggs for food and of birds for domestication as egg producers, he has nevertheless chosen kinds having distinct physiological characteristics. In this respect birds may be divided into two groups: (1) Those in which the young are hatched full-fledged and ready in a great measure to care for themselves, and (2) those in which the young are hatched unfledged and remain entirely dependent upon the parents for some time. Hens and guinea fowls are familiar examples of the first group; robins and sparrows of the second. The eggs of the two classes differ materially in composition, as might be expected from the rôle they play in the development of the young bird, more nutritive material being needed in the first case than in the second, since growth is continued in the egg until the bird reaches a more advanced stage of development. It is interesting to note that the first includes the birds whose eggs are economically important.

The appearance of an egg—the shell with its lining of membrane inclosing the white and the yolk—is too familiar to need any discussion. Each fertile egg contains a germ, or embryo, and is at the same time a storehouse of material for the development and growth of the young individual until it has reached such a stage that life is possible outside the narrow limits of the shell. The embryo is in close relationship with the yolk, which furnishes the nutritive material for its early development, the white being used later. Naturally, yolk and white differ in composition as much as they do in appearance, their food value for man corresponding to the part they play in the growth of the chick.

[1] The danger of exterminating these desirable birds by gathering their eggs for food has been discussed in U. S. Dept. Agr. Yearbook, 1899, p. 270.

DESCRIPTION AND COMPOSITION OF EGGS.

SIZE.

The eggs of different kinds of domestic poultry vary in size as well as appearance, and there is also a considerable range in the size of eggs of different breeds; thus, hens' eggs range from the small ones laid by bantams to the large ones laid by such breeds as Light Brahmas. On an average, hens' eggs are 2.27 inches in length and 1.72 inches in diameter, or width, at the broadest point, and weigh about 2 ounces each, or 8 eggs to the pound (1.5 pounds per dozen). Generally speaking, the eggs of pullets are smaller than those of old birds, those of guinea fowls about two-thirds the size of hens' eggs, those of ducks somewhat larger, while those of turkeys and geese are considerably larger.

COLOR OF EGGS AND ITS RELATION TO THEIR VALUE AND USE.

Considering both wild and domestic birds of all sorts, the eggshell ranges from white to deep colors through a variety of tints and mottlings. The eggs of domestic fowls are not highly colored. Those of hens vary from white to a light or deep brownish tint, the eggs from a particular breed being very similar as regards their color, though varying in depth of color or shade. The eggs of ducks are bluish white; those of geese, commonly white; those of guinea fowls, white or light brown, more or less mottled with a deeper shade; and those of turkeys, usually speckled with a yellowish brown.

Any special coloring in the eggs of wild birds is commonly explained as a protective measure which has been developed to render the eggs inconspicuous in their normal surroundings and therefore less easily found by their enemies. Such reasoning would indicate that the observed differences in the color of hens' eggs are due to characteristics which different breeds have inherited from remote wild ancestors. Of common breeds, for example, Cochins, Brahmas, and Langshans, all belonging to the Asiatic class, lay brown-shelled eggs, while Leghorns and Minorcas, which belong to the Mediterranean class, lay white-shelled eggs.

The color of the shells, whatever its reason, is a feature which has some effect on the market value of eggs of domestic poultry, although not upon their food value (see pp. 4 and 6), the brown-shelled eggs bringing the higher price, for instance, in the Boston market, and the white-shelled eggs in the New York market. In England the preference is decidedly in favor of the tinted eggs. Such local differences probably originated in the fact that some one breed of hens was once chiefly used in a given region and its type of eggs set the standard there.

Extended investigations at some of the agricultural experiment stations, in which many analyses were made of eggs from different kinds of hens, have shown plainly that there are no uniform variations in the physical properties and chemical composition of brown-shelled as compared with white-shelled eggs. Such tests justify the statement that the eggs of any given breed of hens, whatever the color of the shells, are, on an average, as nutritious as those of another breed, provided the eggs are of the same size and freshness and the fowls are equally well fed.

The color of the egg contents is also a matter of interest with respect to market value and domestic uses. Raw egg white has a more or less greenish tinge, which is apparently influenced somewhat by the character of the feed, though no specific coloring matter has been isolated from it. When the albumin is coagulated by heat in cooking, the color varies from white to pale greenish or yellowish tones, hard to define, yet distinct. There is a belief that eggs with shells of the same color should show the same color in the cooked whites and that the cooked albumin of white-shelled eggs is decidedly whiter than that of eggs with tinted shells. Perhaps few persons carry preferences so far as to refuse an egg because of the color of the white, yet it is stated on good authority that in high-class hotels and restaurants, where great attention is paid to details, it has been found that the boiled eggs served must match in color. If, when taken from the shell, one is greenish white and the other clear white, the eggs are often rejected on the ground that one of them is not of the required standard of excellence.

The egg yolk owes its characteristic yellow color to a pigment whose chemical nature has been carefully studied. The depth of the yellow color apparently depends—in large measure, at least—upon the presence of green feed in the ration, and pale-colored yolks indicate that such feed is deficient. Though frequently the yolk is pale, the color which we commonly regard as a standard is a decided yellow, and so the pale-yolked eggs are often said by housekeepers to be inferior, as a given number of such yolks impart to cake or custard less of the yellow color regarded as an indication of richness than do eggs of a darker yolk, a belief which chemical analysis does not justify.

Although, as stated above, variations in color do not imply variations in food value, it is not at all unlikely that there are differences in flavor corresponding to the color of the egg yolk, that which is deep yellow having a more pronounced flavor than the pale one. At any rate, as long as preference for deep-colored yolks and pale whites exists, the poultry raiser who caters to a fancy market should take such factors into account.

FLAVOR OF EGGS AND FACTORS AFFECTING IT.

It is generally conceded that eggs which are perfectly fresh have the finest flavor. After they have been kept for a time, the flavor deteriorates, even if there is no indication of spoiling. Such differences are especially important when eggs are used for table purposes. Stale eggs are not regarded as palatable, and the flavor of spoiled eggs is such that for this, if for no other reason, they are totally unfit for food. The flavor of even perfectly fresh eggs is not always satisfactory, since it is influenced more or less by the character of the food eaten by the laying hens, eggs produced on highly nitrogenous rations, for instance, being inferior to those from a carbonaceous ration. Highly flavored food, such as wild-onion tops and cabbage, may also have a bad effect on the flavor of the eggs produced. This is a matter of importance, especially when poultry is kept to supply eggs for table use.

COMPOSITION.

The shell of a hen's egg constitutes about 11 per cent, the yolk 32 per cent, and the white 57 per cent of the total weight of the egg. The shell of a duck's egg constitutes about 14 per cent of the total weight and that of a plover's egg 10 per cent. The proportion of white and yolk varies somewhat with different breeds of hens, the proportion of yolk being greatest in bantam eggs and, in general, greater with those breeds which are best suited for fattening than with others. Brown-shelled eggs have been found to have a somewhat heavier shell than white-shelled eggs.

The following table shows the composition of hens' eggs (raw and cooked, brown shelled and white shelled) and of egg white and yolk, as well as the composition of the eggs (whole egg, white, and yolk) of guinea fowls, ducks, geese, turkeys, plovers, etc., and that of evaporated eggs and egg substitutes. For purposes of comparison the composition of several other familiar foods is also included.

Average composition of eggs, egg products, and certain other foods.

	Refuse.	Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel value per pound.[1]
Hen:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Calories.*
Whole egg as purchased	11.2	65.5	11.9	9.3	.....	0.9	595
Whole egg, edible portion	.....	73.7	13.4	10.5	.....	1.0	670
White	.....	86.2	12.3	.2	.....	.6	230
Yolk	.....	49.5	15.7	33.3	.....	1.1	1,645
Whole egg boiled, edible portion	.....	73.2	13.2	12.0	.....	.8	730
Duck:							
Whole egg as purchased	13.7	60.8	12.1	12.5	.....	.8	730
Whole egg, edible portion	.....	70.5	13.3	14.5	.....	1.0	835
White	.....	87.0	11.1	.03	.....	.8	200
Yolk	.....	45.8	16.8	36.2	.....	1.2	1,785
Goose:							
Whole egg as purchased	14.2	59.7	12.9	12.3	.....	.9	755
Whole egg, edible portion	.....	69.5	13.8	14.4	.....	1.0	840
White	.....	86.3	11.6	.02	.....	.8	210
Yolk	.....	44.1	17.3	36.2	.....	1.3	1,790
Turkey:							
Whole egg as purchased	13.8	63.5	12.2	9.7	.....	.8	615
Whole egg, edible portion	.....	73.7	13.4	11.2	.....	.9	700
White	.....	86.7	11.5	.03	.....	.8	210
Yolk	.....	48.3	17.4	32.9	.....	1.2	1,660
Guinea fowl:							
Whole egg as purchased	16.9	60.5	11.9	9.9	.....	.8	620
Whole egg, edible portion	.....	72.8	13.5	12.0	.....	.9	735
White	.....	86.6	11.6	.03	.....	.8	210
Yolk	.....	49.7	16.7	31.8	.....	1.2	1,600
Plover:							
Whole egg as purchased [2]	9.6	67.3	9.7	10.6	.....	.9	610
Whole egg, edible portion [2]	.....	74.4	10.7	11.7	.....	1.0	670
Fresh-water turtle eggs [2]	.....	65.0	18.1	11.1	.....	2.9	780
Sea-turtle eggs [2]	.....	76.4	18.8	9.8	.....	.4	740
Salted duck eggs [2]	.....	68.0	12.0	9.2	.....	4.0	595
Desiccated hens' eggs:							
Whole egg	.....	6.4	46.9	36.0	7.1	3.6	2,450
White	.....	11.7	73.2	.3	8.6	6.2	1,495
Yolk	.....	5.9	33.3	51.6	5.7	3.5	2,815
Egg substitute	.....	11.4	73.9	.3	5.3	9.1	1,450
Pudding (custard) powders [2]	.....	13.0	2.1	3.4	80.9	.6	1,645
Shad roe	.....	71.2	20.9	3.8	2.6	1.5	580
Caviar [2]	.....	48.0	29.3	14.0	1.3	7.4	[3] 1,125
Cheese (full cream) as purchased	.....	34.2	25.9	33.7	2.4	3.8	1,890
Sirloin steak as purchased	12.8	54.0	16.5	16.1	.....	.9	955
Sirloin steak, edible portion	.....	61.9	18.9	18.5	.....	1.0	1,100
Milk	.....	87.0	3.3	4.0	5.0	.7	315
Oysters, edible portion	.....	86.9	6.2	1.2	3.7	2.0	230
Wheat flour	.....	12.0	11.4	1.0	75.1	.5	1,610
Potatoes as purchased	20.0	62.6	1.8	.1	14.7	.8	305
Potatoes, edible portion	.....	78.3	2.2	.1	18.4	1.0	380

[1] These values were calculated on the assumption that protein and carbohydrates (each) yield 1,820 (or 4 calories per gram) calories per pound; and fat, 4,080 (or 9 calories per gram) calories per pound.
[2] European analyses.
[3] Including 6.2 per cent common salt.

The above figures represent average values. Individual specimens vary more or less from the average.

As shown by analysis, eggs consist chiefly of two nutrients, protein and fat, in addition to water and mineral matter, or ash. Carbohydrates, valuable in the diet as a source of energy, are present in such small amounts that they are usually not determined in analysis—ducks' eggs containing only 0.3 per cent, hens' eggs 0.67 per cent, turkeys' and guinea fowls' eggs 0.8 per cent each, and goose eggs 1.3 per cent. An exception is found in the case of plovers' eggs, which have been reported to contain over 2 per cent. As regards distribution, about one-third of the carbohydrates occur in the

yolk and two-thirds in the white. The most abundant nutrient is protein or nitrogenous matter, of which three-fifths of the total is present in the white and two-fifths in the yolk. Protein supplies nitrogen needed to build and repair the body tissue, and also some energy, being equal to carbohydrate in this respect, although inferior to fat, as noted on page 9.

It is sometimes convenient to consider the relations of protein and energy in a definite amount of foodstuffs. In the case of a whole egg, 2.4 ounces of the edible portion would be required to supply 100 calories of energy, of which the protein would contribute 36 calories. Of white, 6.9 ounces would be needed to supply 100 calories, and of this amount 97 calories would be contributed by protein. In case of the yolk, 1 ounce will supply 100 calories, of which protein contributes 17.

Mineral matter is required by the body for building bone and other tissue and for regulating the body processes. In addition, recent research has shown that certain accessory substances (so-called vitamins, for example) are also present, which are required by the body in at least minute amounts. Since eggs contribute to all these body needs, their value as food is evident.

In composition eggs resemble such animal foods as meat, milk, and cheese, more than such vegetable foods as flour and potatoes. As will be seen by the figures in the above table, hens' eggs and those of other poultry do not differ greatly in composition. Furthermore, there is practically no significant difference in composition between hens' eggs with dark shells and those with white shells, although there is a popular belief in some localities that the former are richer. Neither does the cooked egg vary materially in composition from the raw, though it varies markedly in texture. The yolk and the white, on the other hand, differ greatly in composition, the yolk containing considerable fat and ash, and the white being practically free from fat and containing somewhat less protein and ash and considerably more water than the yolk. Though both yolk and white, when raw, are fluid, they are not thought of as containing water any more than other familiar foods in which water is not visible as such but combined or mingled with the other constituents so that the whole food is more or less moist, liquid, or juicy. This and similar facts are brought out in figure 1, which shows in diagrammatic form the composition of eggs and egg products.

Though eggs are conceded to be a nutritious food, they are less concentrated, that is, they contain more water than some—cheese, for instance. On the other hand, they are more concentrated than many others, milk or oysters, for instance, and on the whole do not differ greatly in this respect from lean meat. Their general resemblance in composition to other common animal foods suggests that

they may be properly used in the diet in the same way, an idea confirmed by almost universal experience. Such facts are brought out in figure 2, which compares eggs and a number of other common foods.

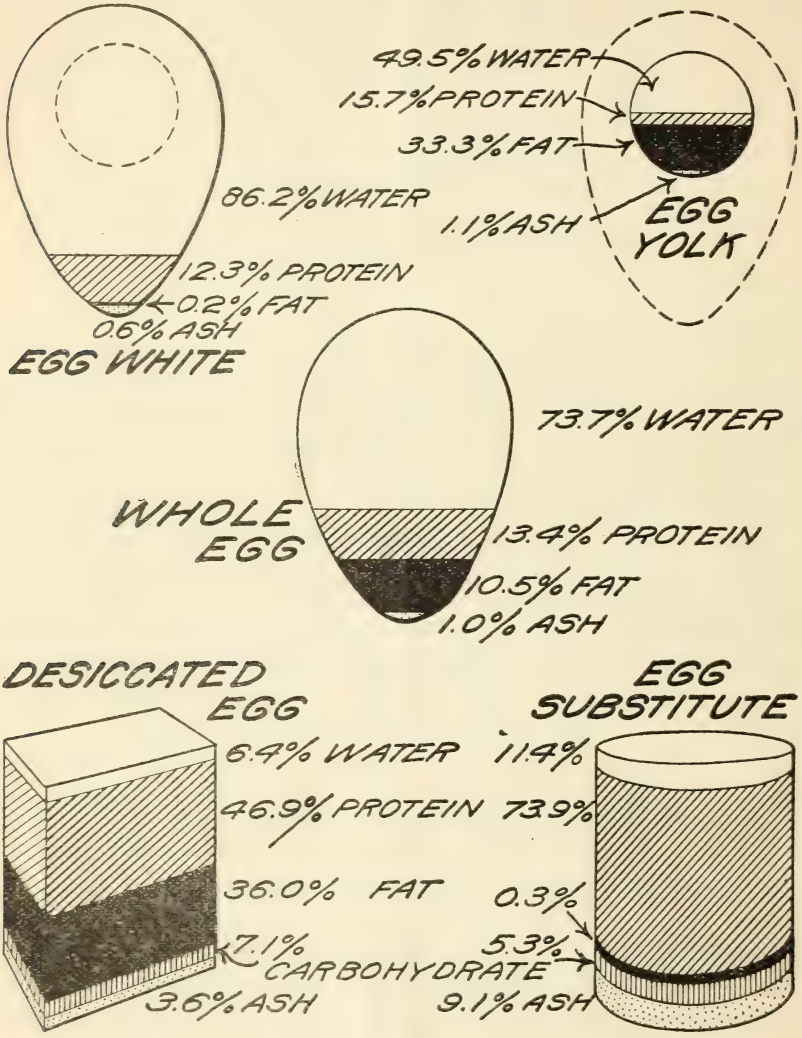

FIG. 1.—Chemical composition of egg yolk, egg white, desiccated egg, and egg substitute.

As sources of energy in the diet, eggs supply per pound a larger number of calories (the common heat unit) than does milk, and fewer than does beefsteak or white bread. This and other facts regarding the energy value of eggs and egg products as compared with some other foods are shown graphically in figure 3. A pound of egg yolk has a much higher energy value than a pound of egg

white, as will be understood when it is recalled that it is the yolk which contains the egg fat and that this constituent has an energy value per pound two and one-fourth times as great as either protein or carbohydrates. Egg yolk approaches full-cream cheese in energy value and has about two-thirds the energy value per pound of bacon, one of the common foods which are characterized by a very high fat content. Desiccated egg, as is the general rule with foods which

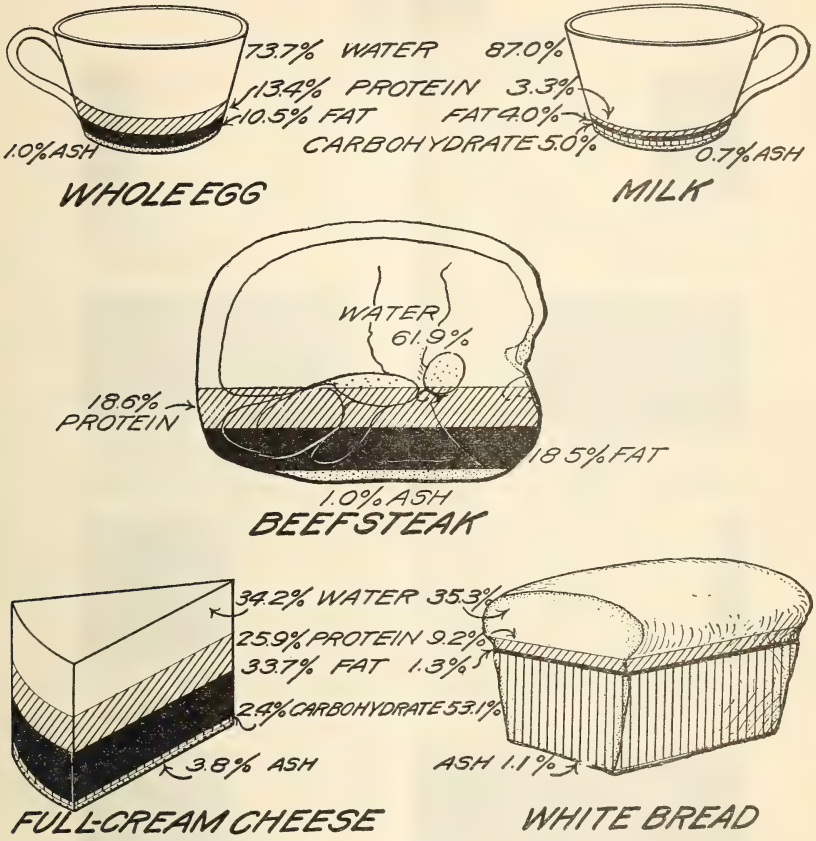

FIG. 2.—Chemical composition of eggs as compared with that of some other common foods.

have been concentrated by the evaporation of water, has a much higher energy value per pound than the fresh eggs.

As regards the specific nature of the different nutrients in eggs, much information is available. Egg white, formerly said to be pure albumin, is now known to contain, in addition to small amounts of carbohydrates, two distinct forms of albumin and a very little mineral matter, chiefly sodium chlorid (common salt). Phosphorus is also present, the amount being equivalent to about 0.03 per cent phosphoric acid.

A very extended investigation of the white of egg was made at the Connecticut State Experiment Station. The "albumen" or protein

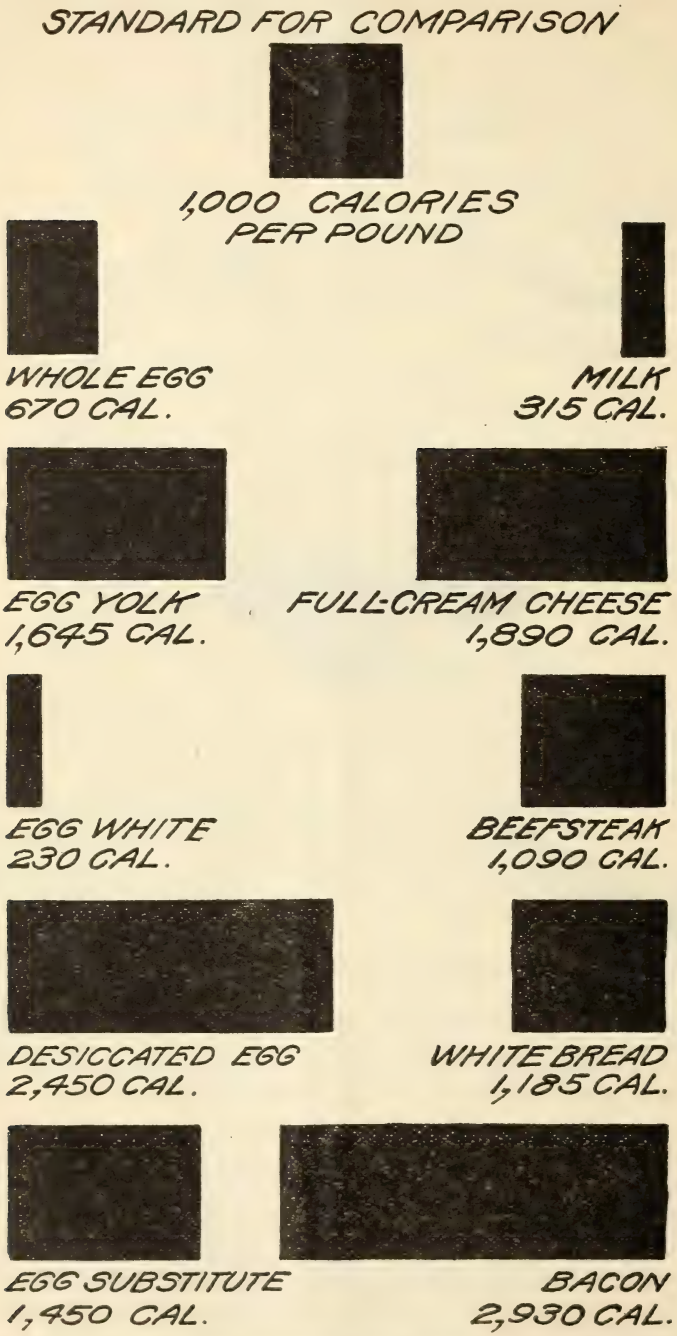

FIG. 3.—Energy value of eggs as compared with that of some other common foods.

of egg white was found to consist of four bodies—ovalbumen, conalbumen, ovomucin, and ovomucoid. The ovalbumen is the chief constituent and makes up the greater part of the egg white. The conalbumen has much the same chemical properties as ovalbumen. Ovomucin and ovomucoid are glycoproteids, and are present in small amounts.

Egg yolk contains a number of different bodies, including about 15 per cent vitellin (a protein); 20 per cent palmitin, stearin, and olein (in the fat); and 0.5 per cent coloring matter (see p. 4), besides some nuclein, etc., lecithin (a fat-like body containing phosphorus and now regarded as one of the very important food constituents, as it furnishes the body with phosphorus in a form in which it may be readily assimilated), and vitamins (see p. 7). Besides phosphorus, equivalent to a little over 1 per cent of phosphoric acid, the yolk contains such mineral elements as iron, calcium, and magnesium.

Since in all cases the egg is designed to furnish the sole source of material for growth and development of the young individual for a considerable time, it is evident that it must contain all the elements required; that is, it must be a complete food for the purpose intended, and this goes far to explain why it is such a valuable food for man. Milk is another familiar example of animal food containing all the elements of a complete food for the young and growing individual, and milk and eggs are frequently, though inaccurately, spoken of as perfect foods on this account and have always been considered especially important in the diet of invalids and children. It is true that they contain all the required elements for the growth and maintenance of the young mammal or the young bird, as the case may be, but this is not the sole test, for the elements are not in the right proportion for the sole nourishment of an adult individual. Man seems instinctively to have recognized this, since he uses eggs, as he does milk, in combination with other foods.

Though rich in iron and calcium, eggs contain an excess of nitrogen, phosphorus, and sulphur, and are, therefore, a predominantly acid food; that is, in the process of digestion an excess of acid end products is formed which the well-being of the body requires should be neutralized with basic substances, best supplied by such foods as fruits, vegetables, etc. The nitrogenous material in eggs, as in milk, is readily assimilated. It is especially noticeable that neither milk nor eggs contain purins, substances which are convertible into uric acid. In general, the iron, phosphorus, calcium, easily digested protein, and fat in eggs make them rank high in the list of foods in a well-selected dietary.

Many experiments have recently been reported concerning the presence in eggs of such substances as the so-called vitamins and the lipoid-

like bodies which are thought to maintain the equilibrium of normal nutrition and to stimulate growth. As yet there is not unanimity of opinion as to the nature or the amount of these substances needed. It seems certain, however, that they are rather widely distributed and that a diet containing eggs, milk, fruits, and the other common foods in wholesome variety is likely to supply a sufficiency.

One of the constituents of egg albumin is sulphur, and the egg albumin is readily decomposed with the liberation of hydrogen sulphid. The bad odor of rotten eggs is due largely to the presence of this gas and phosphureted hydrogen, which is also formed. The shell of the egg is porous, and microorganisms which cause the egg to rot, or spoil, may gain access through the minute openings, and some of these in their growth cause the formation of these sulphur compounds. Even when a fresh egg is cooked, some sulphur is liberated, as is proved by the blackening of silver spoons or forks when they come in contact with boiled eggs. It is a matter of common observation that when eggs are boiled the yolk where it joins the white often has a more or less greenish color. Rubner has found that this discoloration is due to the action of the hydrogen sulphid produced by boiling on the iron of the vitellin of the egg yolk in the presence of alkali (formed when the white comes in contact with the yolk).

In the table no figures are given for the composition of the eggshell, which, of course, is not used as food, though in times past it has had some use in domestic medicine. The shells of hens' eggs are made up very largely of mineral matter, containing 93.7 per cent calcium carbonate, 1.3 per cent magnesium carbonate, 0.8 per cent calcium phosphate, and 4.2 per cent organic matter. The shells of goose eggs, on an average, have the following percentage composition: Calcium carbonate, 95.3; magnesium carbonate, 0.7; calcium phosphate, 0.5; and organic matter, 3.5. The shells of ducks' eggs contain 94.4 per cent calcium carbonate, 0.5 per cent magnesium carbonate, 0.8 per cent calcium phosphate, and 4.3 per cent organic matter. The shells of other eggs are doubtless of much the same composition.

COOKING AND SERVING EGGS.

Methods of serving eggs, alone or in combination with other food materials, are very numerous. Those in which eggs are cooked alone—for instance, boiling, frying, shirring, and poaching—are, in general, simpler than those in which they are combined with other materials.

As regards the uses of eggs in cookery, they serve to improve the flavor, color, and texture of such foods as cakes, while in such dishes as custards and creams they also serve to thicken the material and to give it the desired consistency.

When beaten or whipped, eggs, and particularly egg whites, inclose air bubbles, many more being inclosed by fresh eggs than by packed or old eggs. When such beaten yolks and whites are added to batters or doughs the air bubbles are distributed throughout the mass, and when the dough is cooked the inclosed air expands and the walls of the air bubbles become firm, with the result that the porous structure is retained. Sponge cake and angel cake are familiar examples of foods made light with eggs. It is interesting to note that recipes for cakes and similar dishes to-day commonly call for fewer eggs than those of a generation or two ago. The reason is that, owing to the quite general use of baking powder, the housekeeper is not so often compelled to depend upon eggs to make her cakes light and need use only enough to give the desired flavor, color, and texture. In considering the uses of eggs as an ingredient of cakes and other dishes, it should be noted that they add materially to the nutritive value of the dish as well as to its quality and appearance.

Besides their uses in foods of various sorts, eggs are often employed as a garnish. Hard-boiled eggs, for instance, cut into different shapes, are a common garnish for cooked greens or for salad; or, instead of being cut or chopped, the yolk may be put separately through a ricer.

White of egg is employed for icings, meringues, and confectionery, particularly various sorts of cream candy, and for clarifying liquids (see p. 14).

Since eggs are especially rich in protein, combining them with flour, starch, and sugar (typical carbohydrate-yielding foods) and butter and cream, which are rich in fat, is perhaps an unconscious effort to prepare a food which shall more nearly meet the requirements of the body than any one of the ingredients alone. When eggs, meat, fish, cheese, or similar foods rich in protein are eaten, such other foods as bread, butter, potatoes, etc., are usually served at the same time, the object being, even if the fact is not realized, to combine the different classes of nutrients into a suitable diet. The wisdom of such combination, as well as of other generally accepted food habits, was proved long ago by practical experience. The reason has been more slowly learned.

The total number of methods of serving and preparing eggs is very large, but in nearly every case each is only a more or less elaborate modification of one of a few simple ways of cooking. Thus, an egg in the shell is cooked by immersion in hot or boiling water or is less commonly roasted. An egg removed from the shell may be cooked in hot water or in hot fat. In the latter case it may or may not be beaten or stirred. Combined with other materials to form

various made dishes, eggs are boiled, baked, steamed, or fried, as the case may be.

Changes in weight are often noted when foods are prepared for the table. These vary with the kind of material and the method of preparation, but, in general, loss in weight is due to volatilization, and gain to the absorption of water. Much careful experimenting with eggs cooked in the shell shows that if the egg remains in water a few minutes it loses only a very little material, probably water, which passes out through the porous shell. If it is left in the water for a longer time it may gain weight by absorbing water. In either case the change is too small to modify the food value of the egg appreciably.

Different methods of cooking cause marked changes in the appearance and structure of eggs. Thus, boiled eggs—that is, eggs cooked in the shell in hot, though not necessarily boiling, water—vary greatly in hardness, according to the length of time the cooking is continued, the method of procedure, etc. The directions commonly given for preparing soft-cooked, medium-cooked, and hard-cooked eggs vary. Any of them without doubt will give the desired result if sufficient care is exercised. The chief difficulty is in securing uniform results, especially with soft-cooked or medium-cooked eggs. It must be remembered that such results can not be expected when conditions vary. The time of cooking, the quantity of water used, the number, size, freshness, and temperature of the eggs, and the kind of vessel used are important factors. Thus, eggs which have been kept in an ice chest require more heat to warm them before cooking begins than do those which have been kept at room temperature. Again, so apparently trivial a detail as the sort of vessel used (whether earthen or metal), or the place where the vessel stands during cooking, may produce different results. Even after the eggs are taken out of the water they may continue to cook, and the length of time they stand before using may make a noticeable difference in their consistency. Many persons prefer to have eggs cooked at the table in a chafing dish or other suitable vessel. In such cases the conditions may be controlled with comparative ease, and uniform results obtained with a little practice and care.

As previously stated, egg white, when heated at the temperature of boiling water for a considerable time, becomes hard and contracts. This explains the curdling of custards and the shrinkage and toughening of omelets, soufflés, meringues, sponge cake, and similar mixtures. The firm coagulation of albumin at 212° F. explains the use of egg white for clarifying coffee, soup, or other liquids. The albumin, which is mixed with the liquid before boiling, coagulates and incloses the floating particles, leaving the liquid clear. When eggs are removed from the shell, a little of the white usually clings to the inner surface unless it is scraped. Such eggshells are often used for clarify-

ing purposes instead of the whole egg (see p. 13). The clarifying properties are, of course, due to the egg white and not to the shell.

Eggs are also employed in the arts, for instance, the use of egg white in the manufacture of albumin paper and of egg-yolk oil in finishing leather.

DIGESTIBILITY OF EGGS.

Eggs are commonly said to be very digestible, especially when raw or slightly cooked. Probably most persons would understand by this that they digest without giving rise to pain or other physical discomfort. This is undoubtedly true, but the word "digestible" has another meaning in most discussions of food values. It refers not only to the ease, but also to the thoroughness, of digestion—that is, to the total amount of material that the food gives up to the body in its passage through the digestive tract. The original nature and condition of a food, the method of cooking, and the quantity eaten at a given time are among the factors that determine the amount of any given material that can be digested, but, in general, it is fair to say that the variations are less than is commonly supposed, the quantity of undigested food excreted from the body being usually very small.

Statements often far from accurate are frequently made with regard to the length of time required to digest different foods. Some of them are based on investigations (some old and some recent) which take into account chiefly the length of time food remains in the stomach, assuming that this represents digestion and forgetting that digestion in the intestines must also be considered. Other statements are based on artificial digestion experiments in which the food is subjected in the laboratory to the action of digestive ferments which occur in the body. It is probable, however, that all the conditions of digestibility in the body can not be reproduced in the laboratory, and, although the results obtained are interesting and often valuable, it is worthy of note that careful investigators are much slower to make sweeping deductions from them than are popular writers on the subject.

As regards thoroughness of digestion, that is, the proportion of nutritive material the body retains from a given food, eggs rank high, reliable experiments having shown that, on an average, 97 per cent of the protein and 95 per cent of the fat are assimilated.

The question as to whether eggs are more or less digestible raw, slightly cooked, or hard cooked has also been studied by a number of investigators, the results indicating that, while cooking makes some difference with the rate (as shown by test-tube work), it makes little with the thoroughness of digestion. Even as regards quickness of digestion there is little difference between raw and slightly cooked

eggs. In the case of hard-boiled eggs the yolks are probably as digestible as those of less thoroughly cooked eggs. However, the whites are so firm in texture that, unless they are finely chopped or thoroughly masticated, the digestive juices will not be able to permeate them quickly, and so portions may escape digestion or remain in the digestive tract for several days and decompose. This explains why hard-boiled eggs are often excluded from the diet of little children and invalids and suggests that even healthy adults should be careful to masticate them thoroughly.

From all the evidence it seems fair to conclude that eggs are very thoroughly digested and that the length of time of cooking has less effect upon this factor than upon the time required for digestion in the stomach. In a healthy man the latter consideration is probably not a matter of much importance, as digestion will continue in the intestine. In the diet of invalids it may be more important. However, diet in such cases is a matter for the attention of skilled physicians, and one should be guided by their advice.

Apparently there is no reason for believing that ordinary breakfast beverages (tea, coffee, or cocoa) have any marked effect upon the thoroughness of digestion of eggs, notwithstanding the popular statement sometimes made to this effect.

WHOLESOMENESS OF EGGS.

Eggs are wholesome as well as useful and nutritious food. Overindulgence may lead to digestive disturbance, as it may with any food, but, on the whole, eggs can be eaten by most people in usual quantities without such results. Occasionally, however, a person is found who is habitually made ill by eating eggs, just as there are those who can not eat strawberries or other foods without distress. Such cases are due to some personal idiosyncrasy, showing that in reality "one man's meat is another man's poison." The physiological explanation for them is probably that these persons have become abnormally sensitized to a specific protein body in the egg which will then act as a poison when digested and taken into the circulation.

Under certain conditions eggs, like other foods, may be accidental carriers of disease by conveying to the body harmful bacteria or parasites. It is possible for an egg to become infected with microorganisms, either before it is laid or more especially after it is laid, since the porous shell offers no great resistance to microorganisms, including those which cause it to spoil or rot. If an egg is eaten raw or only slightly cooked, microorganisms, if present, can be communicated to man and may cause disease if they are of the sort to do so. If an egg remains in a dirty nest, for example, defiled with the microorganisms which cause typhoid fever, carried there on the hen's feet or feathers, it is not strange if some of these bacteria occasionally

penetrate the shell and the egg thus becomes a possible source of infection. Perhaps one of the most common troubles due to bacterial infection of eggs is the more or less serious illness sometimes caused by eating those that are stale. This, often called ptomaine poisoning, is more correctly styled food poisoning, and is caused by microorganisms that are commonly associated with filth.

Judged by the comparatively small number of cases of infection or poisoning due to eggs, reported in medical literature, the danger of disease from this source is not very great. However, in view of its possibility, it is best to keep eggs as clean as possible and thus endeavor to prevent infection. Clean poultry houses, poultry runs, and nests are important, and eggs should always be stored and marketed under sanitary conditions. The subject of handling food in a cleanly manner is too seldom thought of, and what is said of eggs in this connection applies to many other foods with even more force. Since it is not wise to wash eggs that are to be kept, only clean ones should be selected for this purpose. Always, when eggs are used, the shells should be carefully cleaned just before they are broken, as otherwise any dirt present on the outside may find its way into the food.

Occasionally the eggs of worms, etc., have been found inside hens' eggs, as indeed have grains, seeds, etc. Such bodies were doubtless accidentally occluded while the white and shell were being added to the yolk in the egg gland of the fowl. This is a rare occurrence and has little to do with the general question of the wholesomeness of the egg. If it should occur the egg should not be used. The bloody spot often found in eggs shows that growth of the embryo has proceeded too far for the egg to be considered of desirable quality.

In general, if one actually has an idiosyncrasy toward eggs one should avoid them. Others should do all they can to secure clean, good eggs, and may then rest assured that these are likely to prove wholesome.

THE SUPPLY OF EGGS FROM THE HOUSEKEEPER'S STANDPOINT.

In order to purchase eggs to the best advantage the housekeeper should be familiar with the source of supply. A generation or so ago each locality depended upon its own farms for eggs, but with the growth of cities and the resulting increased demand this state of things has changed. The eggs raised in the Atlantic and Pacific States are still mainly consumed in or near the place of production, but they are not sufficient to supply these regions, and it is necessary to ship into these regions large quantities of eggs from several of the States of the Mississippi Basin, which produce many more eggs than can be used there. Refrigerator cars, cold-storage warehouses, and special cases devised to prevent breakage make it possible to ship

eggs long distances and keep them for fairly long periods in good condition.

When the housewife depends upon eggs from her own hens, or even when she or the grocer buys direct from a local producer, she can expect to get eggs less than a week old, and the term "fresh-laid eggs" has some meaning. When, however, she buys them in city markets, especially during the autumn and winter months when hens are not laying freely, the chances are that all except a very few high-priced eggs purchased from some local producer were laid at least several weeks before and very likely hundreds of miles away. This does not means that city-market eggs are necessarily bad eggs. On the contrary, when handled by good methods, they may be better in quality than fresh local eggs that have been improperly cared for.

The housekeeper's problem in selecting eggs is complicated by the fact that it is hard to tell the quality of an egg from its appearance. There is undoubtedly a quality in the absolutely fresh, clean egg which is not found in any other and which will last only a day or two under the best of conditions and can not always be secured even in new-laid eggs. This change or loss of quality depends quite as much on the character and cleanliness of the egg and the conditions under which it is held as on the length of time it is kept. Since examination is now almost a necessity in the trade, and the importance of reliable standards of excellence is being recognized the housekeeper should be familiar with the commercial methods.

The main points by which an expert judges the quality of an egg are size, shape, soundness and cleanliness of the shell, and appearance of the interior when candled (held against an opening which permits light to shine through the egg). When an egg is newly laid, its contents seem to fill the shell, as it is seen against the candle, but very soon an air space begins to appear in one end and gradually increases in size until it may fill even half the shell. This shrinking is due to the evaporation of water through the porous shell, and as it increases the weight of the egg decreases. Hence, the old household floating test for eggs—fresh ones sink when put into a pail of water, while old ones float. When a fresh egg is candled the yolk is barely distinguishable from the white, save as a slightly darker area in the center of the egg. In older eggs the yolk looks darker and often shifts its place in the egg. Various kinds of dark spots and blotches may also develop, due to different causes, but all indicating a spoiling egg. When all of the egg meat looks dark in candling the egg is rotten. The art of candling is easily learned and often practiced by housekeepers.

The housekeeper can buy more intelligently if she knows how eggs are graded in the trade and that prices vary accordingly. The grades are commonly designated: "First quality"—large, fresh eggs with

clean, uncracked shells, free from spots or blotches in candling and weighing at least a pound and a half per dozen; "second quality"—eggs which would rank as first except that they either are undersized or have begun to shrink, or eggs in which chick development is just beginning, but has not reached the stage when a blood ring appears. "Dirties" are what the name implies and are always sold at low prices, even when large and fresh. "Checks" are eggs with cracked shells; when the cracks are large enough to let the contents escape, they are called "leakers"; when the cracks are too slight for this they are called "blind." Both of these grades may be sold as food, but they do not keep properly, and they bring low prices. "Spots" and "rots" of various kinds are rarely sold in the shell at retail for table or cooking use, though it is said that large quantities find their way into cheap bakeshop and cheap restaurant dishes, and have at times been used by unscrupulous manufacturers in the preparation of frozen and desiccated products. Many such eggs are used also in tanning leather and for other technical purposes.

The spoiling of eggs is due to two sets of causes, first, the germination of fertile eggs and development of the chick, which is a natural process; and, second, the decomposition by molds or bacteria due to accidental causes. Considering the eggs she keeps on hand at home, as well as those she buys, the housekeeper should realize that each is likely to occur if proper handling and care are lacking and that both are preventable. The surest method of preventing losses due to the development of the embryo is the production of infertile eggs. Mating is, of course, essential to the development of the chick, but if the cocks are separated from the hens as soon as the hatching season ends in the early summer, a large percentage of the loss from bad eggs may be avoided. This is as well worth attention when eggs are home produced as it is in professional poultry raising.

Too much warmth favors both incubation and decomposition, especially in the case of newly-laid eggs. Eggs should be collected promptly and kept in a cool place, especially during hot weather, for heat is just as harmful during the first few days after eggs are laid as it is later, and no amount of care in pantry and refrigerator or in packing rooms, refrigerator cars, and warehouses can give back the good quality to eggs that have lain for several days in a hot nest, been kept in a warm pantry, or been exposed to the hot sun on their way to town.

The loss of quality, due to molds and bacteria in the egg is brought about by their growth and by the chemical compounds, formed by them, which give spoiled eggs their peculiar appearance, taste, and odor. Some of the microorganisms produce a musty taste, and others produce compounds of sulphur and the characteristic odor of rotten eggs. As has already been pointed out (p. 16), some of these

molds and bacteria are not injurious to health, while others may give rise to more or less serious illness. The best way to prevent the infection of eggs by molds and bacteria is to produce infertile eggs and to keep them clean and dry from the time they are laid until they are finally used. The coating of mucilaginous material on the outside of the egg and the very thin membrane, or "skin," on the inside protect the egg from the invasion of molds and bacteria. The shell coating is easily removed by water or by rubbing. Also as eggs grow old the natural protection of the egg becomes less effective. Therefore, deterioration due to molds and bacteria is more likely to occur if the egg is washed or the shell becomes moist by being kept in a damp place. If eggs are dirty enough to wash it is better to do so and use them at once than to "put them down." Neglected and stolen nests (usually dirty and so sources of bacteria, etc.) are probably the chief cause of molded or rotten eggs, and so hens should always have clean, airy nests. Housekeepers who are careful will not choose dirty eggs. If for any reason they must be used they should be carefully washed and wiped.

These causes of spoiling are important matters for the housekeeper, since they have a bearing on supply and market price. It is to the housekeeper's interest to have only eggs produced under good conditions brought to market, because this means less loss in handling and an increased supply of good eggs, which in turn, affects prices favorably.

As a means of securing a supply of fresh eggs for table purposes, the purchase of eggs direct from the producer by parcel post is worth consideration by the housekeeper.

Since eggs vary more or less in size and weight, though very little in composition (see p. 6), it follows that they vary in the amount of food material which they supply. For this reason housekeepers who have a choice very commonly like to select large eggs. That size has an effect on the cost of eggs when they are purchased for a uniform price per dozen is evident when one considers that a dozen pullets' eggs, weighing 18 ounces, at 25 cents per dozen, supplies eggs at 22.9 cents per pound, while hens' eggs, weighing 24 ounces at the same price per pound would supply eggs at 16⅔ cents per pound. Such differences are especially worth considering when eggs are used in quantity. There are few exact household standards for cookery, and using eggs as they come, by number rather than by weight, would probably not imply important variations. However, it is well known that when a recipe calls for 4 eggs one may use instead of 4 of average size either 3 large or 5 small ones.

For reasons of economy as well as accuracy in cookery there is a growing tendency to use eggs by weight or measure instead of by

number. Obviously, such a plan is actually, though not relatively, more economical when large recipes are used, as in boarding houses, hotels, or public institutions, than it is in a home where the family is small.

PRESERVING EGGS AND ITS EFFECT ON THE HOUSEHOLD SUPPLY.

Preserving eggs in one way or another seems to be almost universal and to have been practiced for a very long time, and presumably, like many other everyday things, owes its origin to the observation and experience of generations. The object usually sought is to keep eggs as nearly as possible as they are when new laid. It is not without interest to note that in some regions, notably the Orient, ripening is sought as well as preservation. To insure this the eggs are buried or coated with earth, brick dust, clay, or some other substance, and kept for weeks or months, when they undergo a fermentation or ripening and acquire such a texture and flavor that they are often compared with "ripe" cheese. Egg preservation such as we are familiar with is the opposite of this and attempts not only to prevent such ripening processes, as well as putrefactive changes, but also to hinder or prevent any bacterial or other changes which lessen original quality.

The whole matter of preserving eggs is of importance to the teacher of home economics and the housekeeper, for not only does the housewife preserve eggs for her own use, but the available supply of those she purchases and their cost are directly influenced by such factors.

As regards home storage, housekeepers under most circumstances must keep eggs on hand for short periods for present use, and frequently preserve them when the supply is abundant for use later when fresh eggs are less plentiful. Eggs for present use, that is, those stored for a short time only, should be kept where it is cool and moderately dry—in a refrigerator, for instance, a dry cellar or some similar place. Since they will absorb odors they should be kept away from strong-smelling substances. With such precautions eggs fresh at the start will keep in good condition for use in cookery, as most housekeepers know, for at least two or three weeks. If infertile, they keep longer and in better condition. When one wishes to keep them for a still longer period there are methods of preserving them which can be followed at home with good results.

In general household methods of preserving eggs depend upon the fact that when the pores of the shell are closed, decay is hindered. The reason is that this prevents the entrance of molds and bacteria and hinders the growth of any that may be already present. Among methods often used with more or less success to stop the pores are

burying eggs in oats, bran, or salt; rubbing them with butter; dipping them in melted paraffin; covering them with varnish or shellac; or putting them down in limewater or in a solution of water glass.

As the result of many trials in farm and other homes, as well as at the experiment stations, it is generally agreed that putting down eggs in a solution of water glass or in limewater gives more satisfactory results under home conditions than the other methods mentioned.

Water glass is a popular name for both potassium and sodium silicate. The commercial article (often a mixture of the two) is cheaper and should be used rather than the "chemically pure" water glass for preserving eggs. It is commonly sold as a siruplike liquid, sometimes as low as 1.75 cents per pound in carboy lots, the retail price being perhaps 10 cents per pound on an average.

A solution of the desired strength for preserving eggs may be made by dissolving 1 part of the siruplike water glass in 10 parts by measure of pure water, preferably water which has been boiled to make sure that it is free from mold spores, bacteria, etc. A gallon of the water glass will make solution enough to cover 50 dozen eggs if they are carefully packed.

The eggs should be as fresh as possible (if infertile, so much the better), and packed in a crock, keg, or barrel thoroughly washed and scalded just before its use. Sufficient solution should be poured over the eggs to cover them well. They should be stored in a cool place, not only to prevent the growth of any microorganisms which may have been present before the water glass sealed the pores of the eggshells, but also because water glass will occasionally deposit in patches on the shells if the room is warm.

Many teachers of home economics and housekeepers have asked whether or not water-glass solution can be used a second time. Occasionally this might answer, but since it is far from certain it is not desirable nor worth the risk.

The shells of eggs put down in water glass sometimes crack in boiling, but this can be prevented by sticking a pin through the shell into the air space at the blunt end of the egg before it is boiled.

Limewater, which some consider as satisfactory for preserving eggs, is slightly less expensive than water glass. A solution is made by placing 2 or 3 pounds of unslacked lime in 5 gallons of water and allowing the mixture to stand until the lime settles and the liquid is clear. The eggs should be placed in a clean earthenware jar or other suitable vessel, and covered with the clear limewater. Sometimes a pound of salt is used with the lime, but many persons believe that when this is done the eggs have a slight taste of lime.

Eggs preserved in water-glass solution or in limewater answer admirably most purposes for cookery. Some do not consider them

entirely satisfactory for table purposes, while others do not object to them. Naturally they are used most acceptably in an omelet seasoned with onion, tomato, or chopped green pepper, or in some other form in which seasoning can be used to cover the taste of the egg.

Though many housekeepers can depend upon fresh eggs and eggs stored at home, a larger number must depend upon those which they purchase, and this almost invariably means a dependence for some part of the time upon eggs commercially stored.

Commercial preservation of eggs, which is largely preserving by cold storage, is an industry which has developed very greatly in recent years. The success of cold storage depends upon the fact that low temperature is unfavorable to spoiling; that is, to putrefactive changes, growth of molds, etc., brought about by microorganisms. The development of methods of artificial refrigeration have made possible the use of low temperature for this purpose.

In order that advantage may be taken of favorable climatic conditions, eggs are commonly purchased for storage as early in the year as they are abundant, rather than in the hot months. Since the infertile eggs keep better than fertile ones, they are given the preference for cold storage. It is obvious that the better the egg when it goes into storage the better its quality when used. Within the usual limits of storage, perhaps from six to nine months, eggs do not deteriorate much, and it is not the case, as many teachers of home economics and housekeepers believe, that the shorter the time of storage the better the quality. First-quality storage eggs, on the whole, compare favorably with any except the better grades of fresh eggs, and are certainly more desirable than late summer or early autumn eggs held over by the producer in the hope of securing better prices. As regards their use in the home, cold-storage eggs of good quality are very satisfactory for cookery, and, indeed, many persons find them satisfactory for table use, though those who are very particular about such matters will no doubt always prefer a new-laid egg.

In considering the whole question the housekeeper and the student of home problems should realize that the fact that storage tends to equalize the market and that in many cases one would have difficulty in procuring eggs at all if one could not depend upon those which have been stored.

These matters have been considered here from the standpoint of the home supply and the use of eggs in the home. Those who wish information regarding the production, marketing, or storage of eggs should consult the publications of the Animal Husbandry Division, Bureau of Animal Industry, and of the Bureau of Chemistry.

Whatever her supply, whether fresh eggs, eggs preserved at home, or cold-storage eggs, the housekeeper who wishes to economize should

realize that she should use eggs most freely when they are most abundant and cheapest. When they are high in price she will either give preference to recipes which call for fewer eggs or she will choose dishes which do not require eggs, and to keep up the nutritive value of the diet will depend more upon milk, cheese, meat, and other things which are similar to eggs in respect to the food materials they supply.

FROZEN EGGS, DESICCATED EGGS, AND EGG SUBSTITUTES.

Though eggs, like other animal foods, will keep for a long time when frozen, housekeepers rarely resort to this method of preserving them. It sometimes happens, however, that eggs freeze accidentally. When this is the case they should be thawed slowly (which may be easily accomplished by putting them into cold water and allowing them to stand a sufficient time in a cool place) and used at once.

Commercial frozen eggs—that is, eggs broken and frozen in large containers, with whites and yolks either separate or mixed—are a common product and have found considerable popularity in bakeries and restaurants, where eggs are used in quantity. Obviously, the quality of the product depends upon the grade of the eggs frozen as well as upon the method of handling.

Preserving foods by drying them is a method which is common and often very satisfactory. Many housekeepers find it convenient now and then to dry a few egg whites for use in settling coffee or for some similar purpose. This can be done by spreading the white in a thin layer on a platter or other suitable dish and drying it at a gentle heat in the oven or in the sun.

Several different methods are employed commercially in the preparation of egg powders or desiccated eggs true to name. The whole egg may be dried, or the white, or the yolk. The process varies somewhat, the product being sometimes flaky and sometimes a fine, smooth powder. In general, 90 per cent of the water originally present is removed.

As regards composition, desiccated eggs (see table, p. 6) closely resemble eggs from which the bulk of the water has been removed. Since fresh eggs contain about 75 per cent of water, it would take about 4 pounds to make 1 pound of dry egg. In general, desiccated eggs are readily prepared for use by mixing with a small quantity of water, and practical tests have shown that they give fairly good results when used in cookery. It is also possible to use them, thoroughly mixed with a small quantity of water, for omelets, etc. According to observation, desiccated eggs keep well and are wholesome if well made and handled. Like frozen eggs, they have much the same food value as fresh eggs. At present they are used chiefly by bakers, being generally cheaper than fresh eggs, particularly in

a time of scarcity. They are of interest to the housekeeper as she may find them at times very convenient or economical—for instance, for use on a family camping trip.

As previously stated, eggs are used in cookery for their effects upon consistency and quality of foods as well as for their food value. As many housekeepers know it is possible, when eggs are lacking, to use other foods which will give something the same appearance as eggs; for instance, flour or starch may be used to thicken custards or gelatin used in making an icing or a pudding. The dish may be acceptable, but it goes without saying that the food value would not be the same as if eggs were used.

There are a number of commercial products designed as egg substitutes, some of which approach eggs in composition much more nearly than others. Of these products some are fairly well known to housekeepers, while some are used chiefly in commercial baking and for similar purposes. The various kinds differ much in composition, some being much more like eggs in protein content and energy value than others. In judging such products one should not rely upon appearance, for yellow color does not necessarily indicate other egg yolk characteristics. Some of these egg substitutes, at least, are manufactured from skim milk and are said to contain milk casein and albumin mixed with a little flour. Such a product is evidently rich in protein. Other egg substitutes have been devised which consist of mixtures of animal or vegetable fats, albumin, and starch or flour.

Goods have also been marketed for use as egg substitutes which contain little or no albumin, but which are apparently made up quite largely of starch, colored more or less with some yellow substance. They are commonly advertised for making custards and puddings similar in appearance to those in which fresh eggs are used. If the housekeeper wishes to use them she should not overlook the fact that in the diet they can not replace fresh eggs, since they do not contain the same kind or quantity of nitrogenous matter or fat. This may be an important matter, particularly if such an egg substitute is used in the diet of invalids or children in the belief that it contains the same nutrients as eggs.

IMPORTANCE OF EGGS AS FOOD AND THEIR PLACE IN THE DIET.

That eggs are of great importance in the list of foodstuffs is shown by the last census report, which gives the number produced on farms in 1909 as 1,457,000,000 dozen, or 16 dozen per capita. Their total value was estimated at $306,688,960. If the eggs produced elsewhere than on farms were included this value would be considerably increased. The value per dozen ranged from 15.9 cents to 27.5 cents, with 19.3 cents as the average, and was greatest near large cities,

in mining districts, and in such sections as Alaska and Hawaii, where the egg production was very small as compared with the population and most of the eggs were shipped from a great distance.

The growing importance of eggs is also shown by the growth of the industry. The United States formerly imported a large number of eggs and exported very few. The ratio has changed within recent years, and now the exports largely exceed the imports as the following figures indicate. In 1890 the total number of eggs exported was 381,000 dozen, worth $59,000. In the 12 months ended June, 1915, is was 20,784,424 dozen, worth $5,003,764. In 1890 this country imported 15,000,000 dozen eggs, which were valued at $2,000,000, and in 1915 only about 3,046,631 dozen, valued at about $438,760.

Eggs are used in nearly every household almost every day in one form or another and in varying amounts. From the results of numerous dietary studies it has appeared that on an average eggs furnish 3 per cent of the total food, 5.9 per cent of the total protein, and 4.3 per cent of the total fat used per man per day. For comparison it may be noted that cheese furnishes 0.4 per cent of the total food, 1.6 per cent of the total protein, and 1.6 per cent of the total fat, while milk and cream together furnish 19.9 per cent of the total food, 10.5 per cent of the total protein, and 10.7 per cent of the total fat, in addition to some carbohydrates (which eggs and cheese do not supply in appreciable quantities), and veal and beef together were found to furnish 10.3 per cent of the total food, 24.6 per cent of the total protein, and 19.5 per cent of the total fat.

The amount of nutritive material which a given quantity of eggs will furnish at any stated price per dozen may be readily calculated. When eggs are 25 cents per dozen, 10 cents expended for them will furnish 0.60 pound of total food material containing 0.08 pound of protein and 0.05 pound of fat, the whole having a fuel value of 380 calories. At 35 cents per dozen, 10 cents will procure 0.43 pound of total food material, containing 0.06 pound of protein and 0.04 pound of fat, and furnish 275 calories of energy. At 45 cents per dozen, 10 cents' worth of eggs will furnish 0.33 pound of total food material, supplying 0.04 pound of protein, 0.03 pound of fat, and 210 calories. Ten cents expended for beef at 16 cents per pound will furnish 0.63 pound of total food material, containing 0.12 pound of protein and 0.08 pound of fat and supplying 560 calories. Expended for beef sirloin at 30 cents per pound, 10 cents will furnish 0.33 pound of total food material, containing 0.05 pound of protein and 0.06 pound of fat and supplying 345 calories. If wheat bread is purchased at 5 cents per pound, 10 cents will pay for 2 pounds of total food material, containing 0.18 pound of protein, 0.03 pound of fat, and 1.06 pounds of carbohydrates, and yielding 2,430 calories.

The relative economy of different kinds of food often depends on more than the amount of nutrients which can be purchased for a given sum. This is especially true in the case of eggs, which not only give variety to the diet and furnish an easily digested, nutritious food, especially suitable for breakfast or other light meal (an important item for those of sedentary habits), but also are almost indispensable in many kinds of cooking. It should never be forgotten that when eggs are used in making fancy breads, cakes, desserts, etc., they not only improve the appearance, texture, and flavor of the dish, but also increase its nutritive value.

Many families of moderate means make a practice of buying fresh meat for but one meal a day—that is, dinner—using for breakfast either bacon, dried beef, codfish, or left-over meats, etc., and for lunch or supper bread and butter and the cold meat and other foods remaining from the other two meals, with perhaps the addition of cake and fresh or preserved fruit. It is the thrifty housekeeper, who uses all her material as economically as possible in some such way, who is likely to fall into the error of excluding eggs at higher prices almost entirely from her food supply. If her economy were directed principally to restricting the use of eggs in the making of rich dessert dishes, cake, and pastry, one might not only refrain from criticizing, but welcome the circumstances which necessitated the making of simpler and therefore more wholesome desserts, but usually the housekeeper economizes on eggs by the more obvious method of omitting to serve them as a meat substitute.

The statement so frequently made by housekeepers that eggs at a relatively high price are cheaper than meat at a relatively low price is true in one sense, not, of course, with reference to the total amount of nutrients obtained for the money expended, but because a smaller amount of money is needed to furnish the meal. That is to say, whereas 1.25 pounds of beefsteak, costing 40 cents, at 32 cents per pound, would barely suffice to serve five adults, in many families five eggs, costing 17 cents, at 40 cents per dozen, would serve the same number and probably satisfy them equally well. If the appetites of the family are such as to demand two eggs per person, doubling the cost, they still cost less than the steak at the assumed prices. Many persons eat more than two eggs at a meal, but the average number served per person, it is believed, does not generally exceed two in most families, and experience has shown that very commonly orders in a hotel restaurant are for one egg. Frequently when omelets, soufflés, creamed eggs, and other similar dishes are served in place of meat or fried, poached, or boiled eggs, less than one egg per person is used.

These statements must not be understood as advocating a free use of eggs at any price, but merely as pointing out that even at the higher prices the occasional use of eggs in place of meat need not be regarded as a luxury. This is illustrated by observations made by Miss Isabel Bevier and Miss M. E. Sprague[1] during a dietary study of some 115 women, most of them college students. It was found that the amount of certain foods required for a single meal, when any one of them was served, was: Beefsteak, 36 pounds; mutton chops, 45 pounds; hamburg steak, 24 pounds; sausage, 30 pounds; bacon, 12 pounds; dried beef, 4 pounds; and eggs, 15 pounds, or 10 dozen.

At the price at which board was furnished, steaks and chops were too expensive for use as breakfast dishes. At the time the study was made bacon and dried beef were both considered cheap. Hamburg steak and sausage were regarded as practicable and were occasionally used, but eggs at 22 cents per dozen were thought expensive and at 25 cents per dozen so dear that they could not be used. Yet, as the study showed, at either price the quantity of eggs actually required to satisfy the members of the club cost less than the amount needed of any of the foods except bacon and dried beef. Furthermore, it was easier to utilize boiled eggs not consumed at table than the left-overs of meat. It appears, therefore, that in this case, as regards both economy and palatability, the use of eggs as a breakfast dish was warranted, and the problem discussed is one worth a housekeeper's attention.

The eggs, the steaks, and other materials used were not equivalent in nutritive value, but it must be remembered that other foods were served with the meat or eggs, and that the total amount of nutrients consumed at the meal need not have varied greatly from day to day, although the menu was quite different. Variety from meal to meal and from day to day is recognized as desirable in the daily diet, and this is another reason why such uses of eggs are worth considering.

It is generally recognized that eggs require less time and labor for cooking than most common foods, and for this reason their use as the hot dish at a meal may often be an economy. There are undoubtedly cases in which a small saving of gas or other fuel is of importance, but in many others it is less important than a saving of time or labor. Without question a reason for the popularity of eggs in most households is that they may be so easily and quickly prepared for the table in appetizing ways.

In the case of eggs, like other foods, the income and the need for economy must determine how far and in what ways they are to be used when they are high in price. Judged by their composition and digestibility, eggs are worthy of the high opinion in which they are

[1] U. S. Dept. Agr., Office Expt. Stas. Bul. 91 (1900), and unpublished data furnished by Miss Sprague.

usually held. Furthermore, they are generally relished. Although the physiological reasons were perhaps difficult to find, it was long ago conceded that the attractiveness and palatability of any food must not be forgotten in considering its true nutritive value. Refinement in matters of diet should keep pace with growth in general culture, and foods which please the esthetic sense as well as satisfy hunger are certainly to be preferred to those which serve the latter purpose only, if they can be obtained with the income at one's command.

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